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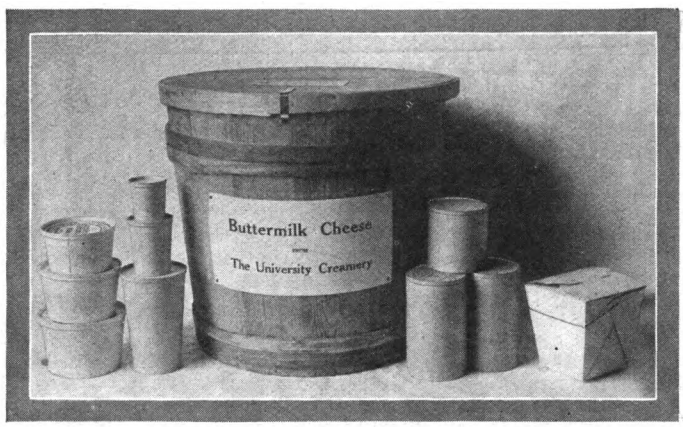
Bulletin 239 June, 1914

Crop Production

Three Creamery Methods for Making Buttermilk Cheese

J. L. SAMMIS

Crop Production



MARKET PACKAGES FOR BUTTERMILK CHEESE

Neat and attractive containers and a well printed display card make a pleasing appearance in the market.

AGRICULTURAL EXPERIMENT STATION
OF THE UNIVERSITY OF WISCONSIN

MADISON, WISCONSIN

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DIGEST

Buttermilk cheese is a food product obtained by curdling buttermilk with heat, draining the curd, and adding salt. It has been described in Bulletins 195 and 211 of the Wisconsin Experiment Station. Large amounts of buttermilk are wasted every year at Wisconsin creameries. If this were made into buttermilk cheese, it would furnish a large supply of palatable food, equal in food value, pound for pound, to lean beefsteak. It can be sold profitably at half the price of meat. Pages 3 to 4

Compared to cottage cheese, buttermilk cheese is superior in flavor and texture. For this reason it is preferred by bakers and for table use. Overheating will not affect its moisture content and little extra equipment is needed for its manufacture. Page 4

The method for making this cheese on the farm is simple, and may be applied on a large scale in the creamery where buttermilk is obtained from raw cream. The process is described in detail. The cost of manufacture is small, the profit to the retailer attractive and the price to the consumer low. A steady market may be obtained with a little effort. Two creameries sold 28,000 pounds during one winter season. Pages 5 to 6

The quality of the curd depends to some extent on the richness of the cream. Buttermilk obtained from cream that was pasteurized while sour requires a special treatment to change a fine grained curd to a coarser texture. It requires the addition of an alkali solution to the buttermilk and the subsequent neutralization of the alkali with hydrochloric acid. The addition of these materials is perfectly safe and increases the cost of manufacture by less than one cent per pound of cheese. Pages 14 to 19

Made with rennet a slight modification of this process is necessary. No hydrochloric acid is used. The alkali solution is added to but one half of the buttermilk, which, when fully neutralized, is mixed with the remaining buttermilk and the entire mass coagulated by the addition of rennet extract. A subsequent heating puts the curd into condition for draining. Pages 21 to 22

The consumer has in buttermilk cheese a new, sanitary food product. The method of manufacture insures sufficient heating for complete pasteurization. The product is, therefore, free from all disease germs and makes a valuable addition to the table. Page 24

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Three Creamery Methods for Making Buttermilk Cheese

J. L. SAMMIS

For many years it was thought practically impossible to utilize pure buttermilk in the manufacture of cheese, it being found much easier to use it when mixed with skim milk. The increased use of the hand separator, however, has steadily reduced the supply of skim milk at the factories so that the use of the mixture has become impracticable. In consequence, new ways of utilizing buttermilk seemed necessary and therefore have been developed. Three of these methods are described in this bulletin.

The first has been successfully used for four years at creameries and in dairies in making the cheese from ordinary buttermilk. The other two processes which have not been published before, deal with the use of buttermilk obtained from cream pasteurized while sour. This is the only kind of buttermilk available at many of the largest creameries.

Waste of Buttermilk Unnecessary

Large quantities of buttermilk are wasted at Wisconsin creameries every year by letting this by-product run into drains or streams. The reasons for this waste have been: first, with the widespread use of hand separators on farms and the consequent abundant home supply of skim milk, farmers have generally neglected to use the buttermilk and have left it at the creamery; second, creamery-men have taken the easiest methods of getting rid of this by-product—either selling it to a neighbor at from five to fifteen cents per hundred pounds, or throwing it away; and third, no good method was known for making buttermilk into cheese.

This last mentioned cause has now been removed and the man-

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ufacture of buttermilk cheese has become a practicable possibility in any creamery or dairy. Moreover, when once introduced to customers in any neighborhood, the product is likely to find ready and continued sale.

THE VALUE OF BUTTERMILK FOR DIFFERENT PURPOSES

Of course the most profitable way of disposing of buttermilk is to retail it for drinking, in which case consumers pay for it at the rate of about $5.00 per 100 pounds. After the cost of transportation from the country creamery to the city market has been deducted, a good share of the proceeds go to the producer, but when the cost of shipping is prohibitive, the manufacture of a more concentrated form of food is preferable. In such cases, buttermilk cheese can be made at small additional expense, and shipped to the market in tubs like butter. When 100 pounds of buttermilk will yield 12 pounds of cheese, which retails at about ten cents per pound, the manufacture of this product is well worth while. Where buttermilk cheese is made, the whey has about the same value for feeding hogs as ordinary cheese factory whey, which is about one-half of the value of skim milk or buttermilk.

Most of the buttermilk now produced at creameries is fed to hogs. In "Feeds and Feeding" Henry states that 100 pounds of buttermilk, properly fed to hogs produce as much gain in weight as 55/100 of a bushel of corn. With corn at 60 cents a bushel, the value of 100 pounds of buttermilk is thus equal to 33 cents. To obtain the full value, however, not over three pounds of buttermilk should be fed with one pound of corn.

Buttermilk has also been used with marked success for feeding chickens. In several states, creameries located near large poultry fattening establishments have a ready outlet for their entire output of buttermilk for this purpose. In a few instances, buttermilk has been evaporated to one-fourth its bulk and shipped in this condensed form for feeding chickens or for other purposes. The preparation of dried buttermilk curd, and its use in fattening poultry are being studied at this Station.

In whatever form creamery buttermilk or its manufactured products are sold, it should bring at least as much as it is worth to the farmer for hog feeding, which at the present time is about 33 cents per 100 pounds.

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Stockholders in any co-operative creamery should insist that the buttermilk be sold in one form or another, and not given away. Even at 10 cents per 100 pounds, the income from the sale of buttermilk may pay 10 per cent or more annually on the value of the building and equipment.

BUTTERMILK CHEESE AND COTTAGE CHEESE COMPARED

Buttermilk cheese is always smooth and fine grained, so that with the addition of a little water it can be rubbed instantly to a creamy consistency. Differing from over dried cottage cheese, it can be moistened when drier than desirable, by stirring in a little clean, cold water which is completely absorbed and retained. The smooth texture of the cheese and its buttermilk flavor give it a rich appearance and quality, and make unnecessary the addition of cream or milk to the finished product.

The principal demand for the cheese has been for table use, where it is spread on bread, either with or without butter, or in sandwiches to which it gives an attractive flavor. German bakers prefer buttermilk cheese to cottage cheese which, hitherto, has been used in making Käsekuchen, and other bakery goods. This preference is due to the fact that cottage cheese, if slightly overheated in the making, very easily becomes dry and tough. On the other hand, buttermilk cheese is not so affected.

In its manufacture the buttermilk is regularly heated for an hour or more to 130 or 140 degrees, or if preferred even to 150 or 160. Without producing any undesirable effects upon the texture or moisture content of the cheese, this insures thorough pasteurization and the absence of disease producing bacteria.

As the buttermilk remains in the vat, ripener, starter can, or other container used for cheesemaking for only about an hour before it is drawn off into the draining rack, no extra vat is required at creameries for cheese making.

The advantages which buttermilk cheese possesses over skim milk cheese are a uniformly smooth, fine grained texture, a buttermilk flavor, the sanitary advantage of necessarily being pasteurized in the process of manufacture, and the fact that it can be made with little extra labor or equipment.

THE MAKING OF BUTTERMILK CHEESE ON THE FARM

The usual method of manufacture can be most simply presented by describing the process as used in the farm dairy or

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home kitchen. When only a few pounds of cheese are made at a time, the buttermilk is heated in a large pan or clean new tin wash boiler to 130 or 140 degrees (about scalding hot) and is then taken off the stove. In about half an hour most of the floating curd can be taken up in a dipper or skimmer. The remaining curd may be collected by pouring the whey through a cheese-cloth-bag, and the entire quantity of curd left from one to four hours in the bag to drain. For draining small quantities of curd a box a foot square and six inches deep with the bottom made of one quarter inch galvanized iron wire netting and covered with one thickness of cheese-cloth may be used instead of a bag. When dry enough, the curd should be evenly salted, one ounce of salt being sufficient for four and one-half or five pounds of curd. The cheese is then ready for immediate use. In the refrigerator it can be kept in good condition for a week or more.

In making the cheese, it is an advantage to let the material stand for a while after heating because the curd will thus have time to rise more or less completely to the top, leaving the clear whey below. It is best to first pour as much as possible of the clear whey from beneath the curd into the bag or draining rack so that the whey may run quickly through the cloth and be disposed of. Thus, the curd comes into the cloth last and the final draining is hastened. The hotter the curd is when put on the cloth the faster it will drain. In this process the dryness of the finished product depends on the time and temperature of draining, and not, as in the case of cheese made with rennet, upon the length of time the curd is kept hot in the kettle before being drained. In working with small quantities of buttermilk, the material if desired can be poured into the draining cloth as soon as heated.

Where large quantities of cheese are made at a time, as at creameries, it is a great advantage to hold the buttermilk undisturbed for an hour before draining at from 130 to 140 degrees. This allows the curd particles to collect into a compact mass, so that most of the clear whey can be drawn out of the vat ahead of the curd, which greatly facilitates the draining process.

CHEESE FROM ORDINARY RAW-CREAM BUTTERMILK

No difficulty will be found in making buttermilk cheese of the best quality at creameries where the cream is either pasteurized while sweet or not pasteurized at all. The method employed

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is practically the same as that used on the farm. The buttermilk is run directly from the churn into any convenient container to which heat can be applied. The wash-water from the butter is not added. A steam heated cheese vat, cream ripener, or starter can is suitable. A tin-lined cream-vat or an old weigh-can may be used, but it is necessary to provide a heating coil, made of two or three turns of one-half inch galvanized or black iron steam pipe. A coil used for heating 150 pounds of buttermilk in a milk can is shown in Figure 1. Any container too heavy

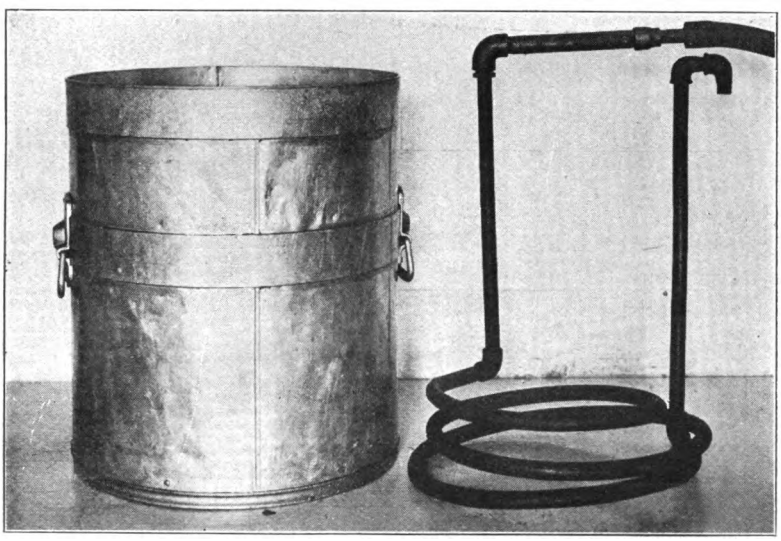

FIGURE 1. STEAM COIL FOR HEATING BUTTERMILK

A milk can or old weigh can may be used for heating the buttermilk and a home-made coil of steam pipes will prove a great convenience in this process.

to tip, to pour out the whey and curd, should be provided with a gate for an outlet.

FIRST, HEAT THE BUTTERMILK TO 130-140 DEGREES

As soon as the buttermilk is in the vat and, usually, before the butter is salted, it is convenient to heat the buttermilk as rapidly as possible, up to* 130 or 140 degrees, stirring enough

* If sweet cream is churned the sweet buttermilk should be treated with starter, heated to 100 degrees, and left several hours to sour and curdle. It is then heated as directed above to 130–140 for making the cheese.

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to insure even heating. The product is coarser grained in appearance, the more gently the material is stirred during the heating.

If the room is very cold, or if preferred for sanitary reasons, the material may be heated to 150 or 160 degrees, without injuring the product or making necessary any other change in the process. It is then left undisturbed for about an hour until the butter-maker can spare a few minutes time to put the curd on the draining rack. The vat should be covered after the heating, in order that it may cool as little as possible, for when put on the rack, the curd drains faster if warm, than if cold. The draining rack can be constructed by any carpenter, and is described below.

SECOND, PUT THE CURD ON THE DRAINING RACK

After the vat has stood for about an hour at 130 to 140 degrees the draining cloth is placed on the rack so as to cover the sides and bottom, and the rack is pushed under the gate of the vat, which should be located near the floor drain. Upon exam-

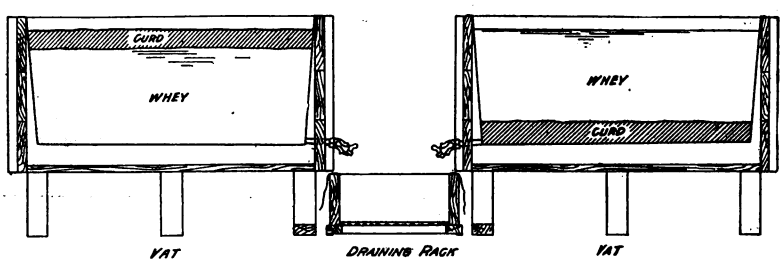

FIGURE 2. SEPARATION OF CURD FROM WHEY

The curd from raw cream buttermilk usually floats on the whey, as shown at the left, but when buttermilk from sour pasteurized cream is used the curd settles to the bottom, as shown at the right.

ination of the vat contents it will be found that the curd has separated from the whey and has collected in a compact mass either at the top or bottom of the whey as shown in Figure 2. Do not stir the vat contents at this point.

If the curd is floating with clear whey beneath, as shown at the left, the whey can be drawn out through the partly opened gate into the draining rack and will run through the cloth and the floor drain to the whey tank. As the whey runs out, the layer of curd in the vat settles slowly and last of all runs

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through the gate and is caught on the cloth. By this means it is easy to get rid of most of the clear whey first and put the curd on the draining rack in the form of a thick mush. It is well to set a small pan under the gate on the draining cloth to prevent the curd from beating through the cloth, at the place where it falls.

In case the curd, after standing at 140 degrees for an hour, has settled to the bottom of the vat as shown at the right in Figure 2, it is best to open the gate only part way at first, so as to draw out as much as possible of the clear whey without greatly disturbing the curd. Afterward, the gate is opened wide and the curd with the small amount of remaining whey is run on to the draining rack. In general, it may be said that curds made by Method No. 1 practically always float at the top of the whey, while curds made by Method No. 2 will always be found at the bottom of the vat after they have stood an hour at 140 degrees. As soon as all of the curd is on the rack, it is covered and left to drain for a few hours or over night.

HOW LONG TO DRAIN CHEESE

An important point in the making of buttermilk cheese is to see that the curd is drained uniformly, so as to be of uniform

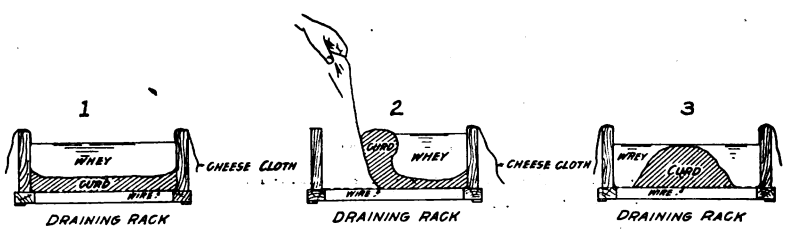

FIGURE 3. THREE STAGES OF THE DRAINING PROCESS

At 1 the curd is lying on the cheesecloth in the bottom of the draining rack; at 2 the cloth is lifted on one side to pile the curd in the center of the rack, and at 3 the operation is completed. This hastens the draining.

consistency from day to day. The beginner will do well to examine the curd at intervals after it is placed on the draining rack. The portions of curd nearest the cloth drain most rapidly and may in some cases become quite dry, while the top of the curd is still saturated with whey, as shown in Figure 3. To hasten the draining, the maker may lift up the cloth at one end of the rack, (See Figure 3) which will cause the dry curd to peel off clean from the cloth and settle in a pile in the middle

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of the rack. Slowly lowering the cloth into place again will allow the loose whey to run down over the clean cloth surface and drain through more rapidly. The cloth should be raised at the other end of the rack also, and the curd rolled into a pile at the middle.

As long as the curd flows like thick mush or mortar when the corner of the cloth is raised, it is too moist to suit the taste of most people. It should always be drained sufficiently before packing, to prevent whey from separating from the curd in the

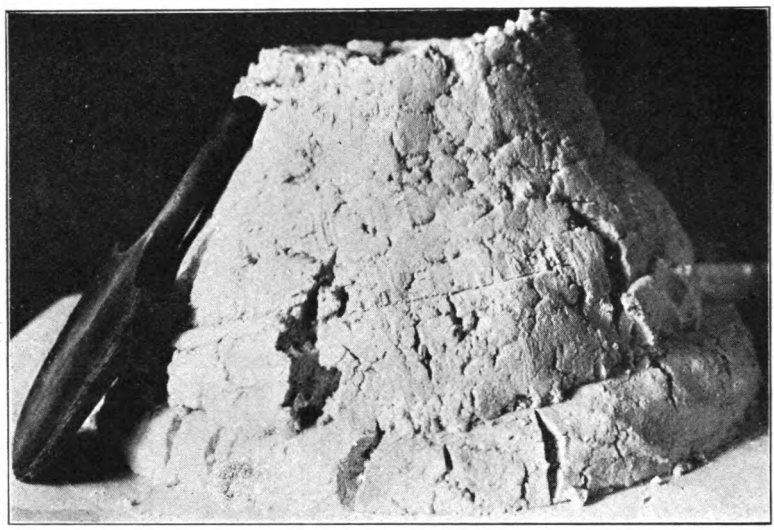

FIGURE 4. FINISHED CHEESE READY FOR PACKING

Properly drained buttermilk cheese has a fairly firm consistency so that when turned out of a tub it will retain its form for a time.

package, or the product leaking out when the container, such for example, as a covered butter tub, is inverted. When properly drained, the mass of curd can be taken out of the draining rack and moulded with paddles into a tall form without losing its shape, as shown in Figure 4. If drained too dry, when piled up it falls apart like damp sand. It would be much better to drain the curd longer than necessary, rather than not long enough, for if too dry the maker or consumer may at any time restore the desired consistency by stirring in a little clear, cold water. On account of the smooth texture and fine buttermilk flavor of the product, it is not customary for the maker to add

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any cream to it before packing, as is often necessary with skim milk cottage cheese. The drier the curd is after draining the harder work it is to stir in salt.

PRESSING THE CURD

The cheese will drain sufficiently on the rack without being pressed. However, if thought desirable curd may be more quickly drained by pressing it under a weight or in a vertical screw press. For this purpose the curd is wrapped in the draining cloth or placed in muslin bags and laid upon pressing racks. These are about two and one-half feet square and are made of wooden strips one inch wide and nailed one-half inch apart. As many racks and bags of curd as are desired may be placed in the press at any one time. Sufficient pressure is applied to keep the whey running out for ten or twenty minutes when the curd will be dry enough to salt. Presses are only used when the curd tends to drain too slowly and are rarely needed.

SALTING THE CURD

The curd should be salted and packed as soon as it is properly drained and before it gets drier than is desirable. Use from one and one-fourth to one and one-half pounds of salt for 100 pounds of curd obtained, or for 800 pounds of buttermilk used. Weigh the salt carefully. Break up any lumps, and sprinkle about half of the salt over the curd while on the cloth, in the rack. Stir it in well. Roll all the curd over by raising the cloth at one side of the rack. Add the rest of the salt, and stir in thoroughly. It is important that every pound of curd sold shall contain its proper proportion of salt.

PACKING THE CHEESE

The salted cheese can be packed for shipment or for local trade in dry butter tubs, either lined or paraffined. When delivered in prints, tubs, or tin pails to retailers, the main portion should be kept in a refrigerator, but an attractive sample from one to five pounds in weight should be placed on the counter in a transparent, covered, glass vessel such as a pickle jar, where customers may see it. It should be plainly labeled "Buttermilk Cheese." For delivery to the consumer in one or two pound lots, it may be weighed into paper pails, such as are commonly used for retail-

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ing oysters and ice cream, or into neat paraffined paper, single service containers (See front cover) which do not absorb moisture. It can also be packed in cartons similar to those in which butter prints are sold. A dry butter printer may be used as a mold. Advertising window cards should be packed with each tub or case of prints sent to a retail store.

STORAGE OF BUTTERMILK CHEESE

Like other perishable food products made without the addition of preservatives, buttermilk cheese must be kept at a low temperature if it is to be stored longer than a few days. Where retailers get a fresh supply two or three times a week, except in the hottest weather, it can be kept without cold storage. In the refrigerator at 50-60 degrees F., it will keep for a week or ten days. If required to be kept for a longer time, it should be stored at 32 degrees or lower, as is done with cottage cheese.

PRICE OF BUTTERMILK CHEESE

Buttermilk cheese, packed in tubs, should sell at the factory for at least four cents a pound. This leaves a good margin of profit for the retailer, who should get from seven to twelve cents a pound. If put up in neat pound or half pound packages, using paraffined paper containers, it should retail at about ten cents a package, like cottage cheese.

Sold at four cents a pound, the 12 pounds of cheese obtained from 100 pounds of buttermilk add 48 cents to the income of the creamery, and with an added expense of less than two cents for steam, salt, etc. The time of the buttermaker is not included here, for less than an hour a day is needed to make the cheese in either large or small lots. Moreover, the work requires only five or ten minutes at a time, at convenient intervals during the day.

At a creamery making 500 pounds of butter and 1,000 pounds of buttermilk, 120 pounds of buttermilk cheese can be made, which packed into two 60 pound tubs, costing 25 to 30 cents each, will yield a net income of about $4.00, if sold at four cents a pound.

FINDING A MARKET FOR BUTTERMILK CHEESE

City creameries which have an ample local outlet for their butter find little difficulty in disposing of buttermilk cheese to their

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local trade. One firm reports the sale of 28,000 pounds of the cheese during one year from their branch creameries in two cities of medium size in the middle West. In every case it is necessary to bring the cheese to the attention of prospective customers, such as store keepers, factory patrons and residents of the vicinity. Where a perishable product such as buttermilk cheese is offered for sale, it is important that the retailer be furnished with attractive window cards for advertising the product to the public, so that it may be sold while fresh.

COLORING BUTTERMILK CHEESE

Some kinds of butter coloring impart a faint color to the buttermilk and also to the cheese made therefrom. If a deeper color is desired in the cheese it may be obtained by adding cheese color, such as is used by Cheddar cheesemakers, to the buttermilk before it is heated to 140 degrees. One-half ounce or more of cheese color may be used for each 1,000 pounds of buttermilk. If a perfectly white cheese is desired, this may be obtained by adding butter color to the churn with the salt, after the buttermilk has been drawn off.

CONSTRUCTION OF THE DRAINING RACK

The draining rack should have about one square foot of draining surface for each 100 pounds of buttermilk handled or for each 12 pounds of curd to be drained at a time. The area of the bottom may be made about half as large as the bottom of the cheese vat used for buttermilk, and the sides of the rack should be about one half as high as the vat is deep. To make a draining rack with as little work as possible, take a wooden dry-goods box about one foot in depth, remove the top and bottom, leaving the sides joined together. For the board bottom substitute a piece of half-inch mesh, galvanized iron wire netting which may be fastened by means of staples. This rack is set on blocks or short legs to raise it a few inches above the floor, but low enough so that it will pass under the gate of the vat in which the cheese is made. A movable cover is made from the remaining boards.

A more substantial draining rack for use in a large creamery is shown in Figure 5 and can be made in the following manner: Make a square frame with mortised joints of 2″ x 4″ dressed

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lumber and fasten the wire netting on top with staples. This is the bottom of the draining rack. A little strip of moulding is put around the outside of this frame on top to prevent the upper half from slipping out of place. The upper half is made of 2″ x 12″ dressed lumber mortised and spiked at the corners. A light wooden frame made of 1″ x 2″ lumber, with muslin or duck tacked on, forms the lid for the draining rack. To prevent the absorption of water the wooden parts should be given two or three coatings of raw linseed oil. Thus treated, the rack will last several years.

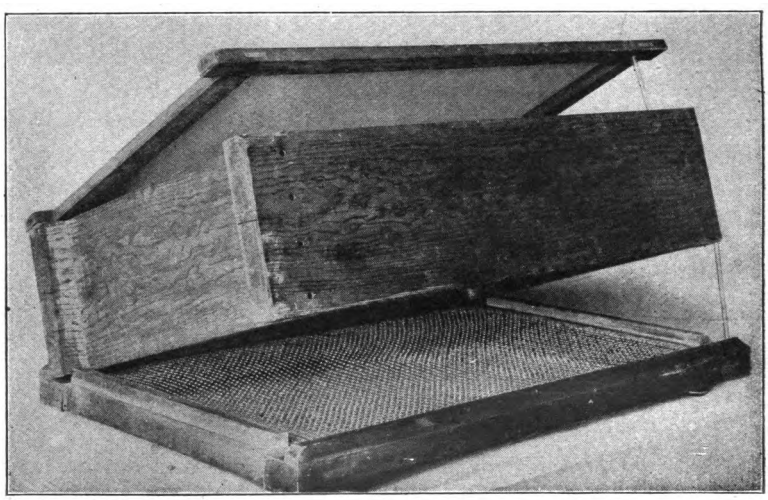

FIGURE 5. A DRAINING RACK FOR A LARGE CREAMERY
The front side is raised to show the three essential parts.

A piece of cheese cloth of good quality is used to cover the sides and bottom of the rack and to hold the curd while draining. If it is necessary to sew two widths of cloth together, lap the edges about one inch, so as to lie flat when in use, and sew two seams about half an inch apart along the lap.

RICHNESS OF CREAM AFFECTS QUALITY OF CURD

It was pointed out in a previous bulletin[1] that the smaller the proportion of milk serum left in the cream, the less flaky and the finer grained will be the curd obtained by heating the

[1] Wisconsin Bulletin 211.

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buttermilk after churning.* Thus, if we draw a 50 or 60 per cent cream from the separator, ripen and churn it, and then as directed above, coagulate the buttermilk by heat, the curd will be a very fine powder, not at all flaky, and it will be impossible to collect it by filtration on cheese cloth. If the cream contains only 20 to 40 per cent butter-fat, the curd from the buttermilk is always somewhat flaky, and is easily collected on cheese cloth, with little or no loss by the method described above. The kind of curd obtained depends on the richness of cream drawn from the separator, and is not affected by subsequent dilution with water of the cream or buttermilk. The only way to get a curd filterable on cheese cloth, from a 50 per cent or richer cream is to add skim milk either to the cream or to the buttermilk. However, it rarely happens that any large proportion of the cream received at a creamery contains more than 35 per cent fat.

HANDLING SOUR CREAM

At many of the largest creameries most of the cream received is quite sour, and is pasteurized in that condition, after which it is cooled, ripened for a few hours and churned. In such cases, the combined action of the high acidity of the cream and the high temperature in the pasteurizer cause the buttermilk, when heated for making buttermilk cheese, to yield only a fine chalky powder, which, with the water present, forms a thin slime. Such curd runs almost completely through the draining cloth and is lost; or if part of it is caught on the cloth, it drains very slowly, and remains in a slimy, sticky condition like thick cream rather than like cheese.

In the previous bulletins on buttermilk cheesemaking, an attempt was made to modify Method No. 1 slightly so as to make it applicable as far as possible to the buttermilk from sour, pasteurized cream. The modification there suggested consisted of first heating the buttermilk to 80 degrees, and after an hour heating it to 130-140 degrees. This double heating is helpful when the acidity of the cream at pasteurization is only moderately high, as at about .25 to .35 per cent. But double heating does not serve to successfully handle the buttermilk from cream pasteurized at .40 to .75 per cent acidity. For all such

*The cause of this is being studied.

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cases either Method No. 2 or No. 3 will be found satisfactory. The quality and appearance of buttermilk cheese obtained from sour pasteurized cream buttermilk by Methods No. 2 and 3 are practically the same and in all respects as good as that obtained from raw cream buttermilk by Method No. 1.

METHOD NO. 2—BUTTERMILK CHEESE FROM SOUR PASTEURIZED CREAM

Briefly described, Method No. 2 consists in first treating the buttermilk to bring the fine grained curd, produced in the pasteurizer, back into solution, or into the same condition as it exists in the raw cream before it is curdled by pasteurization. For this purpose a small amount of pure alkali solution (sodium hydroxide) sufficient to neutralize its acidity is stirred into the buttermilk. A simple test for acidity may now be made by taking a little of the buttermilk in a tea cup and adding a drop of phenolpthalein indicator which will show a red color if enough alkali has been added to the vat. The buttermilk can now be curdled again by acidifying, either by use of lactic acid, or by use of pure hydrochloric acid,* which is cheaper. The addition of both alkali and acid can be finished in a few minutes. The buttermilk treated in this manner curdles when heated as directed below and yields a first class curd.

Buttermilk when taken from the churn often contains as much as .6 to .8 per cent lactic acid. The addition of the sodium hydroxide neutralizes this acid forming a harmless neutral substance, sodium lactate. When the hydrochloric acid is added next, this acid takes most of the soda away from the lactic acid, which is thus set free in the same form as it was at first. The hydrochloric acid and the soda have combined with and neutralized each other, forming a small amount of common salt, some of which is left in the finished cheese. The amount of salt thus introduced into the cheese is not enough to give it a sufficiently salty flavor, so that a little more salt must usually be added to suit the taste before packing the cheese. Only chemically pure hydrocholoric acid, and a good quality of alkali, (such as the caustic soda made from common salt by means of the electric current) should be used. These pure substances

* The addition of more buttermilk instead of hydrochloric acid, here, does not produce a curd of satisfactory quality.

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are free from all harmful ingredients, as lead, zinc, etc. By their combination with each other, only common salt and water are formed, so that no objection can be raised on sanitary grounds to their use in the manner and for the purpose described. Ordinary sulphuric acid and tinner's muriatic acid are not suitable for this purpose.

DETAILS OF PROCESS NO. 2

The buttermilk is run from the churn into the vat or other receptacle in which the cheese is to be made.

The solution of alkali may have been prepared the day before in the following manner. Caustic soda, a purer grade of alkali than ordinary lye, is purchased conveniently in 20 pound tin cans, and the contents of one can is added to an equal weight about one pailful, of water in a crock, or better, in a cast iron or black sheet iron kettle provided with a loose cover. The iron is not attacked by the alkali but galvanized or tin vessels should not be used for this part of the work. It is better to add the dry alkali to the water, rather than the reverse. The mixture heats quickly as the alkali dissolves and the heat may sometimes break an earthenware crock, if used as container. At first the materials should be stirred frequently to secure quick solution of the alkali and prevent the formation of a solid cake at the bottom of the undissolved material. Once dissolved, no more stirring is necessary, and if desired, the solution can be used at once, but it can be handled more conveniently after it has cooled. In general, the solution of alkali should be kept in a covered or stoppered vessel. When the liquid is to be kept in a bottle for some time or is to be transported, a rubber stopper is preferable to one of wood or glass. While standing over night, the alkali cools, and the insoluble substances usually present in small amounts settle to the bottom. The clear alkali solution can be poured or dipped out as needed.

FIRST, ADD AN ALKALI SOLUTION TO THE BUTTERMILK

The solution thus prepared is about 1.53 times heavier than water. A quart of it weighs about 3.2 pounds and contains 1.6 pounds of the alkali. The quantity to be used in any case can be calculated in the following manner:

1,000 pounds of buttermilk, of .75 per cent acidity, contain

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about 7.5 pounds of lactic acid. In all cases, 90 parts by weight of lactic acid are neutralized by 40 parts by weight of the dry alkali, caustic soda. It will be seen that 3.3 pounds of caustic soda (four-ninths of 7.5 pounds) will be required for the 1,000 pounds of buttermilk. Since one quart of the alkali solution contains 1.6 pounds of the alkali, it will be necessary in this case to add to the buttermilk about two quarts or a little more of the solution. Three-fourths or more of the quantity thus calculated can be added at once to the vat and thoroughly stirred into the liquid with an agitator, rake or dipper. It is important to add a sufficient quantity of alkali and an excess does not injure the cheese. To determine whether enough of the alkali has been added, take up a little of the buttermilk from the vat in a cup and stir in a drop or two of the same phenolphthalein that is used in Mann's acid test. If the liquid does not turn at once to a distinct red color a little more alkali should be stirred into the vat of buttermilk and the test repeated. A great excess of alkali should be avoided as being wasteful both of the alkali, and also of the acid which next is added.

SECOND, NEUTRALIZE THE ALKALI WITH HYDROCHLORIC ACID

Chemically pure hydrochloric acid is obtained in carboys holding about 120 pounds and may be added directly to the buttermilk, but as this acid is quite concentrated and fumes somewhat when exposed to the air, it is more conveniently handled if first diluted with an equal volume of water. This may be done by taking a fresh carboy, removing the wooden cover from the neck and loosening the glass stopper by gently tapping it on different sides with a wooden block, never with metal. A one or two gallon glass bottle or a wooden pail (not metal) is is then half filled with water, and set down by the carboy. A piece of rubber tubing of about $\frac{3}{8}$-inch internal diameter and six feet long is filled with water, and both ends are pinched shut with the fingers. One end is dropped quickly into the acid in the carboy, and the other end is then released by the fingers as it enters the pail or the neck of the glass bottle. The flow of the acid from the carboy through the rubber siphon begins at once. When the bottle or pail is nearly filled, the rubber siphon is removed and the water and acid are mixed by shak-

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ing, or by stirring with a wooden paddle. If preferred the acid may be poured out by tipping the carboy.

The volume of this diluted acid needed for a vat of buttermilk is usually about twice that of the alkali solution used. In the example given above, about four quarts of acid would be enough for 1,000 pounds of buttermilk. Most of the calculated amount of acid can be poured into the vat at once and thoroughly stirred through the liquid. The heat test is then applied. This consists of taking from the vat enough of the buttermilk to cover the bottom of a small tin pan. This is set on the surface of a pail of hot water, at about 130-140 degrees. The material in the pan quickly heats, and if it curdles promptly, separating clear whey and a coarse grained curd, enough acid has been added to the vat. The heating and curdling are hastened by gently shaking the pan. If the test portion in the pan does not separate clear why and a course grained curd at the temperature of the pail, a further small addition of acid should be stirred in to the vat and the test repeated. When the test portion curdles well in the pan enough acid has been added and the entire vat of buttermilk is ready to be heated to 130-140 degrees, F. In heating the vat, the whey becomes clear and the curd collects in course grains usually at or below a temperature of 120 degrees. After heating to 130-140, it is covered and left for half an hour, then drained, salted and packed.

Curds made by this method always settle to the bottom of the vat after heating to 140 degrees, leaving the clear whey above. It is desirable therefore, not to stir the vat contents just before drawing off the whey. After placing the draining rack below the gate, open the gate only part way at first, in order to draw out as much as possible of the clear whey first, with the least possible disturbance of the curd. Finally, the gate is opened wide, and the vat tipped so as to run the curd with the remaining whey upon the draining cloth. As this curd contains some salt, formed by the acid and alkali used, it should be tasted after draining is complete, and additional salt added if necessary.

NOTES ON THE SECOND METHOD

1. The addition of sufficient alkali solution to the buttermilk in the first part of this process has the effect of changing its appearance from the whitish opaque color of buttermilk to a

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slightly yellowish or greenish liquid, more like whey. Also, the odor of sour buttermilk disappears, and a different odor takes its place.

2. The addition to the buttermilk (from sour, pasteurized cream) of an insufficient quantity of the alkali to neutralize it, will leave the curd slimy, etc., at the end of the process, as if Method No. 1 had been used instead of No. 2. The addition of a little more alkali than prescribed can do no possible harm to the cheese, and it will merely require a correspondingly greater amount of acid in the next step.

3. Having on hand a stock of the alkali and acid solutions, one may compare their strength with each other, as follows: With a pipette or other small measure, put a measured volume of the alkali in a tea cup, fill half full of water, add a drop of phenolphthalein, rinse out the pipette with water, and then add slowly one, two or three pipettes full of acid from the stock to the cup, while stirring the contents with a stick until the red color of the phenolphthalein disappears. Note the quantity of acid used. When prepared as directed it will usually be found that about two, or two and one-fourth measures of the acid are needed for one measure of the alkali, and this degree of accuracy in the test is quite sufficient. Knowing the relative strength of the acid and alkali solutions, the volume of acid to be added to the vat can be quickly calculated from the volume of alkali used.

4. The addition of acid is always made to the well stirred liquid while cold, before any heat is applied to the vat. If the vat is first heated to 100-140 F., and the acid added afterward to the hot liquid, the curd will be thrown down in fine grains, and will be very hard to collect or to drain. The advantage of Method No. 2, lies in that it permits the curd to be formed slowly at a low or moderately low temperature, (not over 120 degrees.) Formed under these conditions the curd collects always in coarse grains, is easy to handle, and gives good cheese.

5. Before heating, enough acid should be added to the vat to get a good test in the pan. If, by mistake a little more acid than necessary is added, this will do no harm, although a large excess of acid (such as one and one-half or two times the necessary quantity) will produce a sticky curd which drains poorly, and a part of which may be dissolved, reducing the yield. Any great excess of acid should therefore be avoided.

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By throwing a little luke warm water over it, the maker, if he cares to do so may rinse the curd after it is drained on the rack, and allow it to drain again for a short time before adding salt. Any slight excess of acid which may have been added to the buttermilk is thus washed out of the curd without damage to the product.

METHOD NO. 3—BUTTERMILK CHEESE MADE WITH RENNET EXTRACT FROM SOUR PASTEURIZED CREAM BUTTERMILK

In this process, no hydrochloric acid is used. Half of the available buttermilk may be run into the vat and neutralized with the alkali, and the remainder then added; or as more convenient, all of the buttermilk may be run into the vat, and a movable partition put in, across the middle of the vat. The partition should fit fairly well, so as not to fall down, but need not fit perfectly. The construction of a partition of sheet metal or wood, as shown in figure 6, presents no difficulty. The necessary quantity of alkali to fully neutralize the buttermilk on one side of the partition is then added and mixed by stirring. It is essential that about half of the buttermilk first be neutralized *fully* as here described; it is not sufficient to add the same quantity of alkali to the entire vat full without the partition, as this will half neutralize all of the buttermilk, but fully neutralize little or none of it, and will give a fine grained, mushy, slimy product.

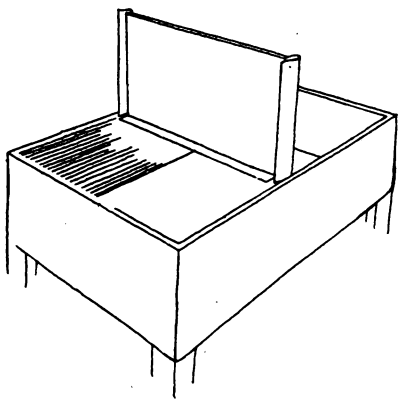

FIGURE 6. MOVABLE PARTITION FOR DIVIDING CHEESE VAT

The sheet metal flanges on the sides and bottom of the partition are readily bent by hand to fit the vat snugly. The partition remains firmly in place while the alkali is stirred in, and can then be lifted out with ease.

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After neutralizing half of the buttermilk, remove the partition and stir in the other half. Rennet is added at the rate of 20 cubic centimeters, or ⅔ ounce, per 1,000 pounds of buttermilk, first adding the rennet to some clean water, equal in volume to about one-half or one percent of the buttermilk, and then stirring the diluted rennet through the vat contents. The vat is then heated rapidly to 105-110 degrees, with occasional stirring, since rennet acts more rapidly at about 108 degrees. It is covered and left to stand quietly at this temperature for one half to one hour, until the maker has time to attend to it. During this time, the curd separates from the whey. If the whey appears very milky, because of incomplete coagulation, it will become clearer during the next step of the process. The vat contents are next heated quickly to 130-140 degrees. covered and left for an hour with occasional stirring. During this time the curd settles, expels whey, and becomes quite firm, so that it will drain rapidly when put on the cloth of the draining rack.

NOTES ON PROCESS NO. 3

The complete neutralization of about half of the buttermilk furnishes enough fully dissolved casein for subsequent coagulation with rennet, so that the rennet coagulum, when formed, encloses and carries down the entire content of curd, leaving clear whey. Also the coarse flaky character of the rennet curd predominates, so that the entire product appears coarsely flocculent.

If the same quantity of alkali be added to the entire vat of buttermilk without the partition, so little fully dissolved casein is formed that the powdery character of the curd formed by heat predominates, and the product is slimy and unsatisfactory.

After the vat is fully curdled by rennet, the curd is so soft that it can hardly be felt by the hand passing through the whey. After the vat has been at 130-140 degrees for an hour, the rennet curd is well firmed and coarsely granular, and drains in an hour or less on the rack.

The acidity of the buttermilk just before adding rennet may be any where between .20 and .35 per cent, but if much higher, as at .40 to .50 per cent, the rennet curd is fine grained and the final product unsatisfactory. Therefore, it is not sufficient to

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fully neutralize one-fourth of the buttermilk instead of one half as directed above.

The use of slaked lime as a means of neutralizing the buttermilk in place of sodium hydroxide is not satisfactory, because the curd obtained afterwards with rennet is fine grained and slimy.

The buttermilk being half neutralized in this method, the final product has not quite so acid a flavor as that obtained by either Method No. 1 or No. 2. In other respects, it is practically indistinguishable in taste and appearance, whether made by one process or another.

Method No. 1 has been in use for over four years; Method No. 2 has been used, following our directions, by some of the largest city creameries for over a year, while Method No. 3 has been developed more recently at this Station, but has given satisfaction up to the present time.

COST OF MAKING BUTTERMILK CHEESE

The cost of steam heat and labor for making buttermilk cheese by the first method is quite small, as the work is done at odd times and not over an hour of the maker's time is required altogether during the day, in handling a large vat of buttermilk. Where the second method is used, the extra cost for acid and alkali may be estimated as follows for 1,000 pounds of buttermilk:

3.3 pounds caustic soda at 14 cents per pound	$0.46
5.0 pounds C. P. hydrochloric acid at seven cents per pound	.35
Total	$ .81

As 1,000 pounds of buttermilk yields about 120 pounds of the finished cheese, it will be seen that the cost for acid and alkali is less than one cent per pound of cheese.

A good grade of caustic soda, at least 96.5 per cent pure, and the chemically pure hydrochloric acid required can be obtained from dealers in chemicals in any large city.

The cost of making the cheese can be reduced further by using rennet extract instead of hydrochloric acid, according to Method No. 3, described above. For this purpose, only half as

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much alkali is used as in Method No. 2, so that the costs per 1,000 pounds of buttermilk are as follows:

1.7	pounds of caustic soda at 14 cents per pound	$0.24
20	cubic centimeters of rennet extract, at $1.80 per gallon	.01
	Total	$ .25

FACTS OF INTEREST TO THE CONSUMER

Buttermilk cheese is a sanitary food product. It has about the same food value, pound for pound, as lean beef steak, which sells at twice the price. Large numbers of city and country residents, to whom the prices of meat, eggs, etc., are objectionably high, find in buttermilk cheese a palatable and economical food.

In addition to ordinary cleanliness in its manufacture, the buttermilk used is heated to a pasteurizing temperature, 140 degrees or higher for an hour, during the cheesemaking process. Such pasteurization is sufficient to kill disease germs such as those producing tuberculosis, typhoid fever, dysentery, etc.

In the household buttermilk cheese is eaten alone or like cottage cheese, mixed with cream, seasoned with salt, mixed with 2 to 5 per cent of Spanish pimiento, paprika, chopped pickles, olives, or nuts, or used in salads. On account of its smooth texture, it can be spread on bread like butter and thus used in sandwiches, either with or without butter. The addition of pimiento or paprika colors the cheese pink.

Bakers prefer buttermilk cheese, on account of its invariable smoothness of texture, for making cheese-cake and other bakery goods, in which they formerly used cottage cheese.

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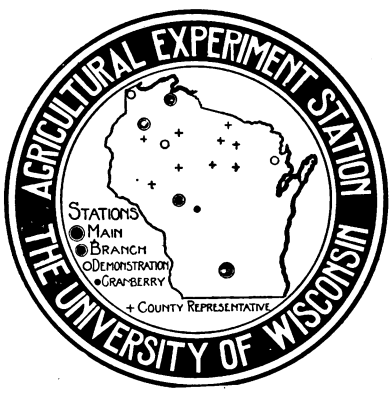

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